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EXAMINER

WINTER, GENTLE E

ART UNIT

PAPER NUMBER

1746

3

DATE MAILED: 04/04/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/628,036

Applicant(s)

WHITNEY ET AL.

Examiner

Gentle E. Winter

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1746

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 October 2000.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-83 is/are pending in the application.
- 4a) Of the above claim(s) 64-83 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-63 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
- If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
- a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) <u>2</u> . | 6) <input type="checkbox"/> Other: |

DETAILED ACTION

Election/Restrictions

1. Restriction to one of the following inventions is required under 35 U.S.C. 121:
 - I. Claims 1-63, drawn to a process for adhesion promotion, classified in class 216, subclass 34;
 - II. Claims 64-72 drawn to a metal substrate, classified in class 428, subclass 544 and;
 - III. Claims 73-83 drawn to a laminated metal body, classified in class 174, subclass 261.
2. Inventions of Group I and Groups II and III are related as product and process of use. The inventions can be shown to be distinct if either or both of the following can be shown: (1) the process for using the product as claimed can be practiced with another materially different product or (2) the product as claimed can be used in a materially different process of using that product (MPEP § 806.05(h)). In the instant case
3. Inventions of Group I and Group II are related as process of making and product made. The inventions are distinct if either or both of the following can be shown: (1) that the process as claimed can be used to make other and materially different product or (2) that the product as claimed can be made by another and materially different process (MPEP § 806.05(f)). In the instant case the process as claimed can be used to make other and materially different product, specifically a three layer metal-metal-polymer composite structure. Additionally, that the product as claimed can be made by another and materially different process. Specifically limitations regarding the method of making a product is when the product is claimed is given minimal weight. In the instant case any method of removing material at the grain boundary would within the scope of the claim e.g. abrasion, ablation etc. Similarly the limitation "immersion plating" requires only that the metal be deposited, many methods are available for such deposition, including sputter deposition.
4. Group III is distinguishable in that it is drawn to a laminated body including three layers, thus distinguishing it from Group II. It is distinguishable from group I, because it can be made by a plurality of different techniques, as disclosed above with reference to Group II.

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5. During a telephone conversation with Thomas Adams on or about March 5, 2002 a provisional election was made without traverse to prosecute the invention of a process for treating a metal substrate to improve adhesion, claims 1-63. Affirmation of this election must be made by applicant in replying to this Office action. Claims 64-83 are withdrawn from further consideration by the examiner, pursuant to 37 CFR 1.142(b), as being drawn to a non-elected invention.

6. Because these inventions are distinct for the reasons given above and have acquired a separate status in the art as shown by their different classification, restriction for examination purposes as indicated is proper.

Drawings

7. The drawings do not comply with statutory requirements including 37 CFR 1.4(g) (inadequate margins). Correction is required. The objection to the drawings will not be held in abeyance.

Specification

8. The disclosure is objected to because of the following informalities: page 20 line 19 there appears to be a software/printing issue regarding the superscripts on the R.

The lengthy specification has not been checked to the extent necessary to determine the presence of all possible minor errors. Applicant's cooperation is requested in correcting any errors of which applicant may become aware in the specification.

Claim Objections

9. Claim 25, appears to have a redundancy in the recitation of both "one or more" *and* "or mixtures thereof". Seemingly the deletion of: "or mixtures thereof" would correct this matter.

Claim Rejections - 35 USC § 112

10. The following is a quotation of the first paragraph of 35 U.S.C. 112:

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The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

Claim 9 is rejected under 35 U.S.C. 112, first paragraph, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. Specifically, it is not clear, based on the specification, how the etchant could achieve an aspect ratio of at least 5. Seemingly, the grain boundary would have to be etched, almost to the complete exclusion of the grain material. This seems somewhat unlikely in light of the inherently required etchant the transport properties, i.e. much more etchant would contact the grain surface than would contact the highly recessed grain boundary. Further, since claim 1 fails to explicitly disclose what is meant by "immersion plating", it is assumed that both electro- and electroless plating are contemplated. If this is the case, it is not clear how one would provide even marginal coverage in the deep recess, which would seemingly be substantially devoid of required charge.

Claim Rejections - 35 USC § 112

11. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-63 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1, 14, 25, 29, 30 recites an improper Markush group. Specifically, it is not clear if Applicant contemplates a solution having 16 (or more) different metals in the immersion plating composition.

Claims 2-4, the expression "at least about" is indefinite (see *Amgen, Inc. v. Chugai Pharmaceutical Co.*, 927 F.2d 1200, 18 USPQ2d 1016 (Fed. Cir. 1991)).

Claim 19, it is not clear if there is a loop or if the metal is simply submerged for a finite period of time. If the reference only requires that the metal be in a plating tank (or equivalent)

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for a finite period of time, this seemingly fails to narrow claim 1, which discloses immersion plating.

Applicant is reminded that any amendment must be supported by the application as originally filed.

Claim Rejections - 35 USC § 102

12. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

The changes made to 35 U.S.C. 102(e) by the American Inventors Protection Act of 1999 (AIPA) do not apply to the examination of this application as the application being examined was not (1) filed on or after November 29, 2000, or (2) voluntarily published under 35 U.S.C. 122(b). Therefore, this application is examined under 35 U.S.C. 102(e) prior to the amendment by the AIPA (pre-AIPA 35 U.S.C. 102(e)).

Claims 1-8, 10-25, 28-32, and 53-63 are rejected under 35 U.S.C. 102(e) under United States Patent No. 6,242,079 to Mikado et al.

Regarding claims 1, 2, 3, 4 and 10-12, and 19 United States Patent No. 6,242,079 to Mikado et al. discloses in the Abstract a process for treating a metal substrate to improve adhesion of polymeric materials thereto. Specifically, Mikado et al. discloses a process: [W]herein the adhesion property between the underlayer conductor circuit and the interlaminar resin [polymer]...are improved. Mikado goes on to disclose an intergranular etch procedure for roughening the metal substrate see FIGs 4 *et seq.* and associated text. Finally Mikado discloses in FIG. 18, and associated text a one-sided circuit board 15 having conductor circuits 19 with a roughened surface 17 according to the invention covered with a metal layer 18, and the metal layer is made of at least one metal selected from the group consisting of titanium, aluminum, zinc, iron, indium, thallium, cobalt, nickel, tin, lead, bismuth and a noble metal. Please note that

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absent extraordinary processing virtually all metal forms grains and thus has grain boundaries. Further, etching a metal having a grain boundary will virtually always result in the etching of the grain boundary. Therefore, despite the lack of explicit disclosure of "intergranular etching" figures 1-12 depict the etching of grain boundaries or--intergranular etching. Mikado discloses that the board is immersed in an electroless copper plating bath under...conditions to form an electroless copper plated film 44 of 1.6 micron in thickness over a whole of the roughened surface. See FIG. 28 and associated text. The "continuous process" limitation is understood to mean that there is no interruption in the plating process. In the Mikado et al. Abstract, Mikado et al. [W]herein the adhesion property between the underlayer conductor circuit and the interlaminar resin [polymer]...are improved.

Regarding claims 5, 6, 7 and 8, Figure 6, shows a intergranular etched surface with an aspect ratio of at of at least 2, and since at an aspect ratio of least 2 would subsume an aspect ratio of at least 1. Further, in column 11 lines 31 *et seq.* Mikado et al. discloses intergranular ridge concentrations ranging from about 0.34 per square micron to over 10 per square micron. Column 18 line 30 discloses the depth of the recess portion formed in the roughened surface is...about 1-5 microns. The SEMs of figures 1, 2, and 3 show a 1-micron square wherein at least 90% of the squares include at least one intergranular surface having an aspect ratio of at least 1. In specific regard to claim 8, FIG. 6 shows an aspect ratio of at least 2, and the SEMs of FIGS 1-3 show the requisite concentration.

With respect to claims 13-15, see column 21 line 3, disclosing the application of silane over the plated metal surface. The silane solutions would inherently have a pH in the range of about 2 to 8 and could come from one of the recited sources, therefore while not explicitly disclosed the limitation is inherently present in Mikado et al.

Regarding claims 16 and 17, see column 17 line 49 *et seq.* disclosing the use of a solution of tin borofluoride-thiourea, tin chloride-thiourea or the like. A thiourea compound is generally accepted to be subset of a urea compound.

With respect to claim 18 see column 18 lines 60-65. Disclosing that a liquid composition adopted in the usual manner can be used as an electroless copper plating solution. For example, a liquid composition comprising copper sulfate.

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Claim 20 is anticipated by column 29, lines 61-67 disclosing a 23 second immersion in a plating bath.

Claim 21 is anticipated by column 17 lines 43-50 disclosing an immersion plated metal layer of 3.9 microinches to 79 microinches.

Claims 22-24 are anticipated by Mikado et al. at column 17 line 49 and column 18 lines 33 *et seq.* disclosing the use of a solution of tin borofluoride-thiourea, tin chloride-thiourea or the like (a salt of a plating metal and a stannous salt and complexing agent), and an inorganic acid (mineral acid). Water is not explicitly disclosed but is inherently present.

Claim 25 is addressed in the anticipation rejection of claim 1 disclosing resin, and see also column 17 lines 51 *et seq.* disclosing epoxy resin.

With respect to claims 28-31 see column 12 line 46 *et seq.* disclosing a copper (II) complex, and organic acid. Column 13 line 20 discloses that a halogen may be added to the etching solution. Illustrated examples include fluorine ion, chlorine ion, bromine ion or the like. Water is explicitly disclosed at line 31 of column 13. The organic acid is disclosed to be *inter alia* formic acid at column 13 line 12. Hydrochloric acid is explicitly disclosed at line 24.

Regarding claim 32, 53-63, Mikado et al. discloses an etching solution including an oxidizer (oxygen containing liquid) see column 12 line 50 *et seq.*, an acid (organic) column 13 line 9 *et seq.* a corrosion inhibitor (metal film) column 11 line 56 and a source of halide ions column 13 lines 20 *et seq.* and the amount of the copper (II) complex of the azole is preferably 1-15% (greater than 4 grams per liter) by weight. With respect to claims 54 and 55 see column 12 line 46 *et seq.* Showing the reaction that would inherently result in the concentration of the lower oxidation state metal (copper in this case) being less than 2 grams per liter of the composition. Mikado et al. discloses an inorganic acid, sulfuric acid, in column 18, line 30, and an organic acid column 13, line 9. The organic acid taught includes formic acid see column 13, lines 9 *et seq.* inorganic/mineral acids taught include sulfuric and phosphoric acids. Column 17 lines 49 *et seq.* discloses the use of a solution of tin borofluoride-thiourea, and at column 17 lines 49 *et seq.* Mikado et al. discloses the use of a solution of tin borofluoride-thiourea. The reaction shown with copper(I) copper(II) is also disclosed to work with tin column 17 lines 43 *et seq.*

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

2. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by United States Patent No. 3,650,861 to Angell.

Angell discloses a process for treating a metal substrate to improve adhesion of a polymeric material. Angell discloses at column 3 line 20 *et seq.*:
Sheets of ... titanium ... a grain size of 0.013 mm. ... etched ... [and] electroplated with platinum ... and ... subjected to the ... adhesion test.

Since the process steps are the same (i.e. the intergranular etching of a surface of a metal substrate, and electroplating with metal) the process would inherently improve the adhesion of polymeric materials.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 33-40 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mikado et al. in view of United States Patent No. 3,773,577 to Shibasaki et. al.

Regarding claims 33 and 37, Mikado et al. as described above, discloses all the feature of claims 33 and 37 except that Mikado et al. does not teach:

Regarding claims 33 and 37: An etching composition with a water-soluble polymer. Shibasaki et. al. (column 2, lines 42 *et seq.*) teaches the use of a water-soluble polymer—polyethylene-glycol. An artisan, desiring to enhance the etch rate would have been motivated

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to select polyethylene-glycol as an ingredient to increase the etch rate. Shibasaki et. al. specifically states that the etch rate is increased with the addition of polyethylene-glycol.

Regarding claim 34: An oxidizer selected from hydrogen peroxide and persulfates. Shibasaki et. al. (column 2 line 37 *et seq.*) teaches the use of hydrogen peroxide. An artisan interested in increasing the concentration of oxygen in a solution or oxidizing a chemical species or element would have been motivated to use hydrogen peroxide as the source of oxygen. See for instance United States Patent No. 5,800,859 to Price et al. (Abstract) disclosing an adhesion promotion solution including hydrogen peroxide, an inorganic acid, an organic corrosion inhibitor and a surfactant, see also United States Patent No. 5,869,130 to Ferrier (hereinafter Ferrier) disclosing that:

The oxidizer used in the adhesion-promoting composition may comprise any oxidizer which is capable of oxidizing the metal surface in the matrix of the adhesion-promoting composition. The inventors have found hydrogen peroxide and persulfates to be particularly preferred oxidizers for use in the process of the invention, with hydrogen peroxide being the most preferred oxidizer.

Regarding claim 35: Concentration of the oxidizer is from 6-60 grams per liter and the concentration of acid is from 5-360 grams per liter and the concentration of corrosion inhibitor is from 1-20 grams per liter and the concentration of halides ions is from 5-500 milligrams per liter.

Mikado et al. discloses that the acid is preferably within a range of 0.1 to about 30% by weight. (column 13, lines 9 *et seq.*) Thus the acid concentration is anticipated, and the motivation would be the same as above.

Mikado et al. also discloses the concentration of the corrosion inhibitor is preferably between 1 and about 15% by weight (column 13, lines 5 *et seq.*). Thus the concentration of corrosion inhibitor is anticipated and the motivation is the same as above.

Mikado also discloses that the concentration of halogen ion is favorably within a range of 0.01 about 20% by weight. (column 13, lines 25 *et seq.*) Thus the concentration of halide ions is anticipated and the motivation to combine is as set forth above.

Shibasaki et. al. discloses that the concentration of the oxidizer to be between 2-30%, preferably 5-15%. This value is widely taught in the literature and an artisan would have been motivated to develop a workable adhesion promotion composition would look to the efforts of

others in the field. Since the recited range is closely mirrored in multiple references the artisan would select the recited values as a matter of course. See also the teachings of Ferrier disclosing that the concentration of the oxidizer in the adhesion-promoting composition may range from 6 to 60 grams per liter but is preferably from 12 to 30 grams per liter (column 4, line 51 *et seq.*).

Regarding claim 36: Shibasaki et. al. discloses the use of the corrosion inhibitor benzotriazole (claim 1). Shibasaki et. al. provides the motivation for making the combination by disclosing that the rate for etching copper is significantly decreased when a small amount of halogen is present, and goes on to disclose that this decreased rate is avoided if benzotriazole is present. Therefore the artisan in an attempt to avoid the etch rate consequences of the halide addition would have been motivated to include benzotriazole in the etching solution.

Regarding claims 38-40, Mikado et al. as described above, discloses all the feature of claims 38-40 except that Mikado et al. does not explicitly teach the concentration of hydrogen peroxide. The inorganic acid (phosphoric acid) is taught by Mikado at column 18 lines 33 *et seq.* the corrosion inhibitor (triazole) is taught at column 13 lines 1 *et seq.* and the surfactant is taught at column 27 lines 25 *et seq.* Shibasaki et. al. discloses that the concentration of the hydrogen peroxide to be between 2-30%, preferably 5-15%. This value is widely taught in the literature (*identical* values taught in Price et al. United States Patent No. 5,800,859) and an artisan would have been motivated to develop a workable adhesion promotion composition would look to the efforts of others in the field. Since the recited range is closely mirrored in multiple references the artisan would select the recited values as a matter of course. See also the teachings of Ferrier disclosing that the concentration of the oxidizer in the adhesion-promoting composition may range from 6 to 60 grams per liter but is preferably from 12 to 30 grams per liter (column 4, line 51 *et seq.*). And United States Patent No. 5,800,859 to Price et al. disclosing (3rd paragraph of detailed description) that hydrogen peroxide is present in the adhesion promotion composition at a concentration of at least 0.01% by weight active hydrogen peroxide and preferably at least 1.0% by weight hydrogen peroxide. The concentration of hydrogen peroxide is no greater than 20%.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 41 is rejected under 35 U.S.C. 103(a) as being unpatentable over Mikado et al. in view of Price et al.

Regarding claim 41, this claim is rejected further in light of Price et al., disclosing a peroxy sulfuric acid with a quaternary ammonium cationic surfactant. The surfactant disclosed by Mikado et al. is not explicitly cationic. An artisan would have been motivated to select a functional surfactant. The listing of a "cationic surfactant" requires no inventive skill. Surfactants, as a class, are routinely selected as wetting agents and solubility aids.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 42-48 are rejected under 35 U.S.C. 103(a) as being unpatentable over PCT WO 99/40764 to Grieserin et al. (Grieserin et al.) in view of Mikado et al. and further in view of United States Patent No. 4,882,202 to Holtzman et al. The Abstract of Grieserin et al. discloses a method for enhancing adhesion between a metal substrate and a polymeric material. (Pretreatment Of Copper Surfaces To Increase The Interlaminar Bond Strength In Copper-Plastic Laminates, Especially Printed Circuit Boards). The method provides for the intergranular etching of the metal substrate identically discloses the additional claim limitations set forth in

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claim 42. Page 18 identically discloses the additional claim limitations disclosed in claim 43. Page 6 identically discloses the additional claim limitations disclosed in claim 44. Page 5 appears to identically disclose the additional claim limitations disclosed in claim 45. Page 6 appears to identically disclose the additional claim limitations disclosed in claims 46-47 and page 8 appears to identically disclose the additional claim limitations disclosed in claim 48. Grieserin et al. does not disclose the immersion-plating step. United States Patent No. 4,882,202 to Holtzman et al. discloses a process for improving the adhesion of a metal layer of a printed circuit board to the non-conductive surface of a circuit board comprising coating the metal layer with an immersion tin composition. The artisan would have been motivated to use the immersion-plating step of Holtzman et al. to improve the polymer/metal adhesion of Grieserin et al. The use of intermediate layers, having good adhesion properties with both a substrate and superstrate is widely used in both finishing technology (where a primer is used, in part, to enhance adhesion between a metal substrate and a polymer coat). Further, a metal strike layer is often used to enhance the adhesion of subsequently plated metal. Thus the concept of putting down an intermediate adhesion-enhancing layer is well known. Similarly the concept of roughening a surface, thereby increasing surface area (and bonding area), is well known and widely practiced in the PCB manufacturing arts. (see for instance Mikado et al. and references therein)

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 42, 43, 46 and 49-52 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mikado et al. in view of United States Patent No. 6,117,250 to Schemenaur et al.

Regarding claims 42, 43, and 46 Mikado et al. teaches all the limitations of claim 42, except Mikado et al. does not teach the addition of an adhesive compound having...a heterocyclic compound containing at least one sulfur atom in the heterocycle. Schemenaur et al. discloses, in claim 1, such an etch solution, and specifically identifies that this should be used for etching metal surfaces, for the purpose of improving adhesion. An artisan seeking to improve adhesion would have been motivated to select an etching solution, which has disclosed application in the area of adhesion promotion. With respect to claim 43 Mikado teaches the addition of a triazole (see above). With respect to claim 46, Schemenaur et al. column 2, line 25 *et seq.* discloses the addition of a thiazole compound to the solution. The stated purpose is to effect "substantial improvements in acid-resistance" to etched surfaces. An artisan seeking to improve adhesion, and protect the intergranular etched surface from damage related to subsequent acid exposure would have been motivated to select an etching solution which has disclosed application for such use.

With respect to 49 and 51 Schemenaur et al. disclosing a surface roughening intergranular etching procedure in column 3 lines 12 *et seq.* in light of claim 9. The proton source is disclosed to be *inter alia* phenylsulfonic acid. The concentration, "between about 0.5 to 7.5 moles per liter" is within the specified range. An artisan seeking to improve adhesion would have been motivated to select an etching solution, which has disclosed application in the area of adhesion promotion.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 26-27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mikado et al. in view of United States Patent No. 5,073,456 to Palladino disclosing *inter alia* (c) applying a silane bonding mixture to the surface on a layer and the silane bonding mixture including a ureido silane, a disilyl crosslinking agent. See column 3, lines 1 *et seq.* The Artisan would have been motivated, by a desire to create a PCB that resisted delamination, to combine the teachings of Mikado et al. (superior adhesion) with the teachings of Palladino. Additional motivation can be found in the Mikado et al. (Technical Field) the desirability of a printed wiring board having an excellent adhesion property between a conductor circuit for solder pad and a solder resist layer.

Allowable Subject Matter

8. Claim 9, has no art-based rejections pending. If the non-art rejection(s) are overcome and the claim(s) are rewritten in independent form, including all of the limitations of the base claim and any intervening claims, the claim, based on the current understanding, is believed to recite patentable subject matter.

9. The following are considered relevant:

- a. United States Patent No. 6,036,758 to Fairweather. Disclosing a composition useful for the surface treatment of copper, in particular for micro-roughening of the copper surface so as to improve the adhesion characteristics of the copper surface, comprises an oxidizing agent for copper and an aromatic sulfonic acid or a salt thereof. In a preferred embodiment, the oxidizing agent is hydrogen peroxide and the aromatic sulfonic acid is sodium m-nitrobenzenesulfonate. The composition preferably also includes an inorganic acid such as sulfuric acid and a corrosion inhibitor such as benzotriazole. Considered especially relevant to claims 49-52, not specifically included because thought to be cumulative.
- b. States Patent No. 5,907,015 to Sexsmith. Disclosing an adhesive composition based on a combination of a water soluble amino silane and a normally water-immiscible alkenyl-functional silane...thus forming a stable, water-dilutable aqueous composition having marked bonding affinity between polymers and solid substrates.

- c. United States Patent No. 5,807,493 to Maki et al. disclosing a composition comprising cupric ion, organic acid, and a halide ion. Wherein the composition provides a superior microetching effect and produces a roughened copper or copper alloy surfaces for better adhesion.
- d. United States Patent No. 5,733,599 to Ferrier et al. disclosing a process for enhancing the solderability of a surface through the use of immersion silver deposits is disclosed. In the preferred embodiment two immersion deposits are utilized in sequence. A composition for immersion silver plating is also disclosed.
- e. United States Patent No. 5,712,047 to Aso et al. discloses a copper foil for PCB including copper, zinc, and carbon. Produced by dipping a copper foil in a non-cyanide copper-zinc electroplating bath containing a copper salt, a zinc salt, a hydroxycarboxylic acid or a salt thereof, an aliphatic dicarboxylic acid or a salt thereof and a thiocyanic acid or a salt thereof, and using the copper foil as a cathode to form on at least one surface of the copper foil a carbon-containing copper-zinc coating.
- f. United States Patent No. 5,554,211 to Bokisa et al. discloses that one or more metals selected from the group consisting of tin, lead, bismuth, indium, gallium and germanium may be deposited onto a metal surface utilizing an aqueous electroless plating solution which comprises: (A) at least one solution-soluble metal salt selected from the group consisting of a stannous salt, (B) at least one acid selected from the group consisting of ...alkane sulfonic acids, alkanol sulfonic acids, and mixtures thereof; (C) a complexing agent which is an imidazole-2-thione compound (D) water and optionally, the aqueous plating solution may contain one or more surfactants (cationic is specifically identified). This patent is considered especially relevant to claims 53-63, and is considered to be cumulative to the cited art.
- g. United States Patent No. 5,073,456 to Palladino disclosing *inter alia* (c) applying a silane bonding mixture to the surface on a layer and the silane bonding mixture including a ureido silane, a disilyl crosslinking agent. This patent is considered to be especially relevant to claims 13-15 and 26-27.
- h. United States Patent No. 4,642,161 to Akahoshi et al. disclosing a method of bonding copper and a resin together is disclosed which comprises forming a copper oxide

layer on the surface of copper to be bonded to a resin, reducing the copper oxide layer to metallic copper with a reducing solution, and bonding the metallic copper and the resin together. According to this method, a good acid resistance of the bonding interface and a sufficiently high bonding strength can be obtained. This process is similar to the present invention except that the immersion-plating step is replaced by an oxide reduction step.

Conclusion

10. The following is a statement of reasons for the indication of allowable subject matter: Claim 9 teaches immersion plating an intergranular crevice having an aspect ratio of at least 5 for improved adhesion. The prior art of record does not appear to contemplate such a dramatic aspect ratio, with the subsequent plating step.

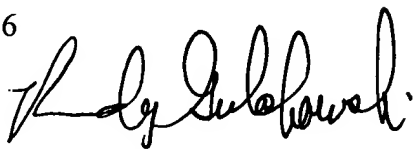
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Gentle E. Winter whose telephone number is (703) 305-3403. The examiner can normally be reached on Monday-Friday, 8:30-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy P. Gulakowski can be reached on (703) 308-4333. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9310 for regular communications and (703) 872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0661.

Gentle E. Winter
Examiner
Art Unit 1746

March 25, 2002


RANDY GULAKOWSKI
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